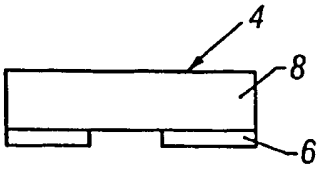


FIG. 1

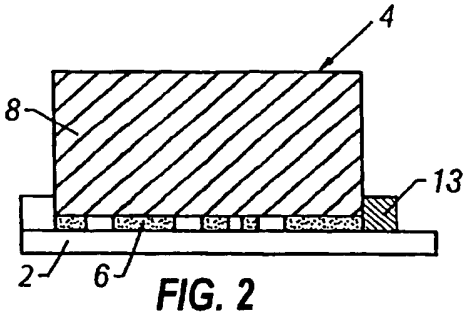


FIG. 2

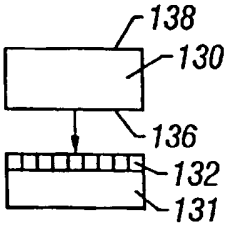


FIG. 3a

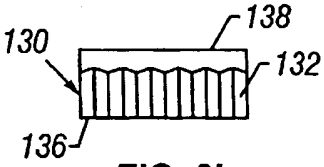


FIG. 3b

FIG. 3c

FIG. 3d

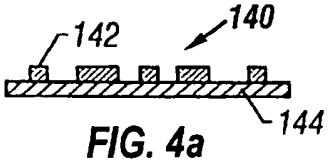


FIG. 4a

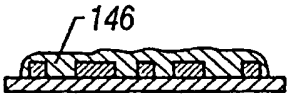


FIG. 4b

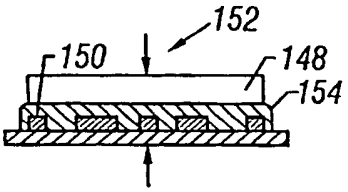


FIG. 4c

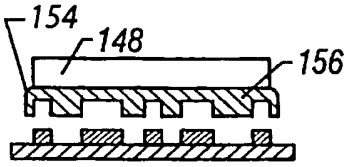


FIG. 4d

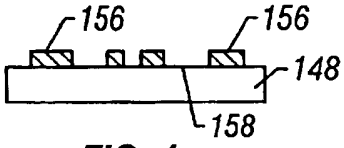


FIG. 4e

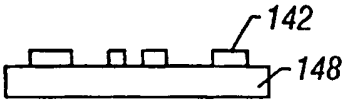


FIG. 5a

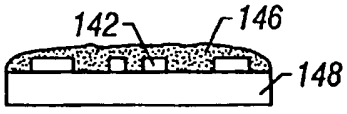


FIG. 5b

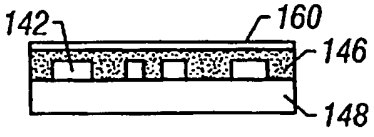


FIG. 5c

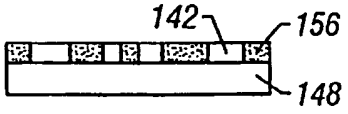


FIG. 5d

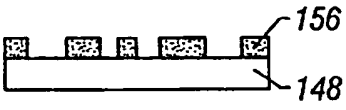


FIG. 5e

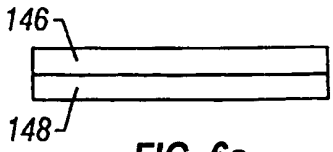


FIG. 6a

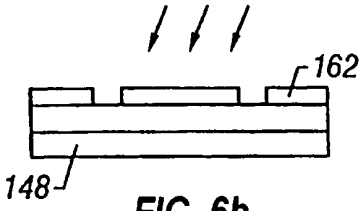


FIG. 6b

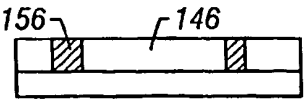


FIG. 6c

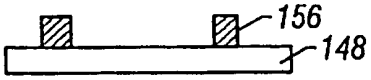


FIG. 6d

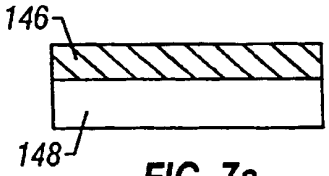


FIG. 7a

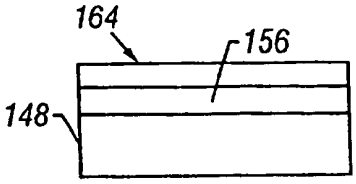
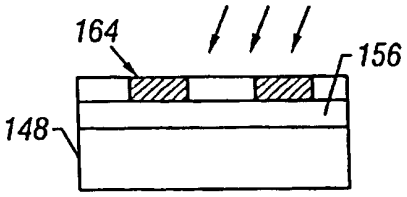


FIG. 7b



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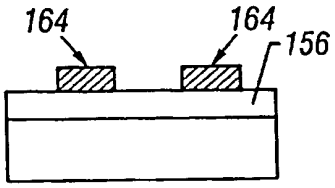

FIG. 7d

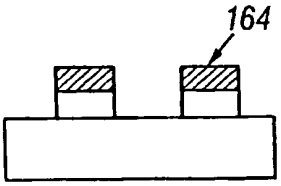

FIG. 7e

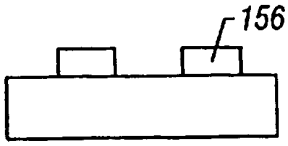

FIG. 7f

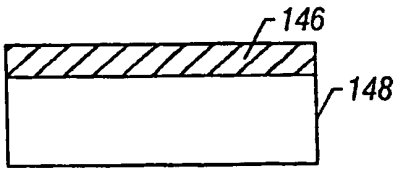

FIG. 8a

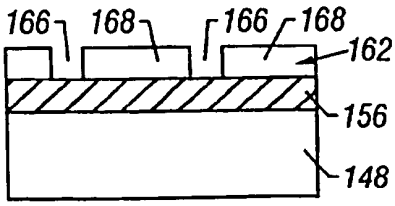

FIG. 8b

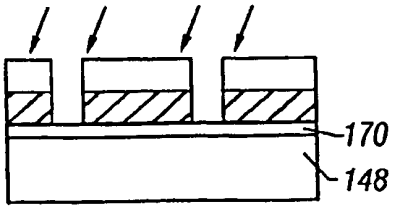

FIG. 8c

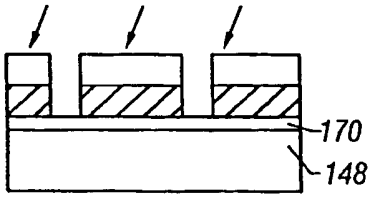

FIG. 8d

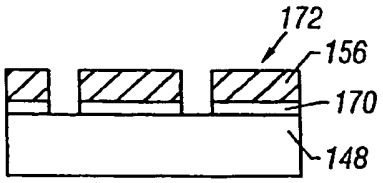

FIG. 8e

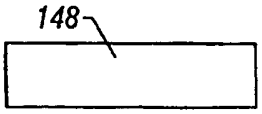

FIG. 9a

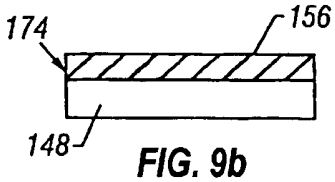

FIG. 9b

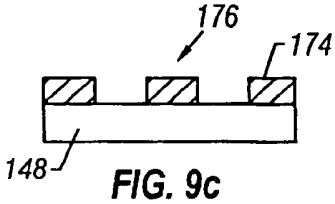

FIG. 9c

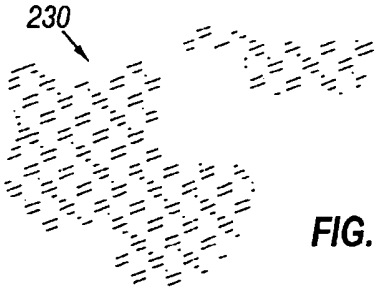

FIG. 10a

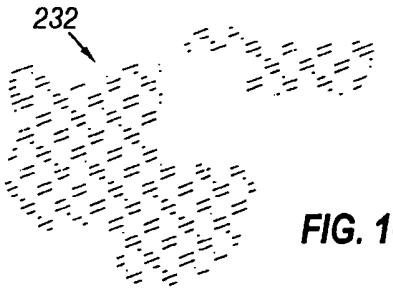

FIG. 10b

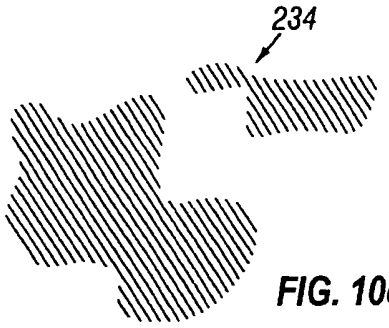

FIG. 10c

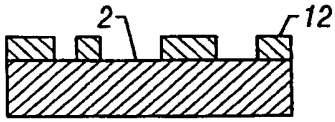

FIG. 12a

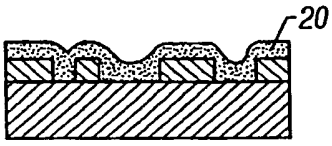

FIG. 12b

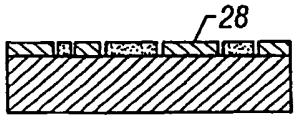

FIG. 12c

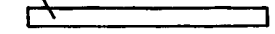

FIG. 11a

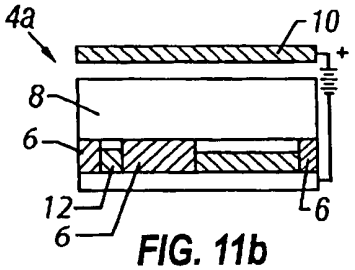

FIG. 11b

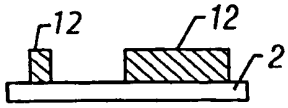

FIG. 11c

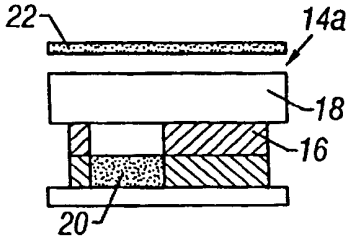

FIG. 11d

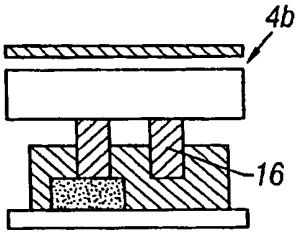

FIG. 11e

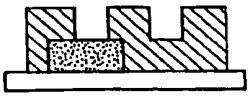

FIG. 11f

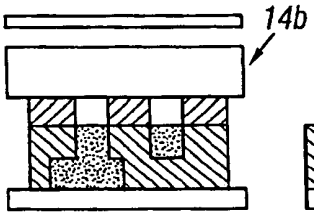

FIG. 11g

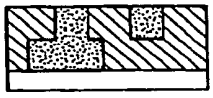

FIG. 11h

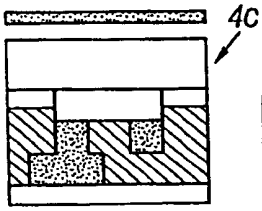

FIG. 11i

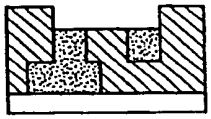

FIG. 11j

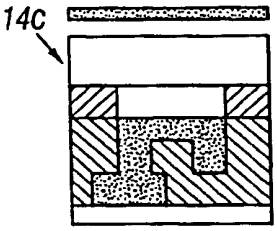

FIG. 11k

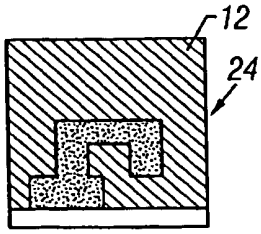

FIG. 11l

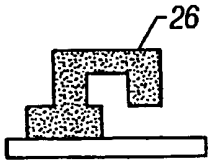

FIG. 11m

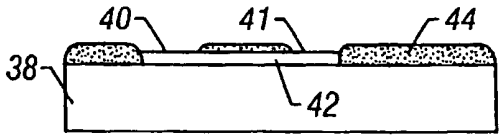

FIG. 13a

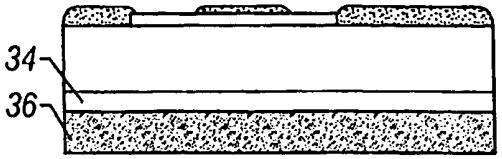

FIG. 13b

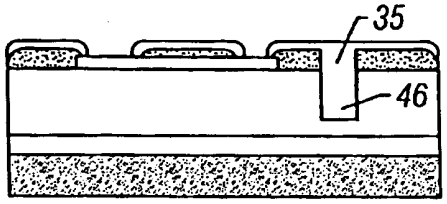

FIG. 13c

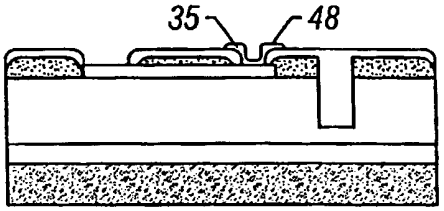

FIG. 13d

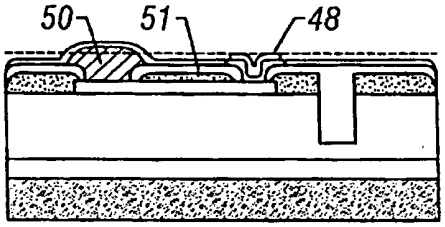

FIG. 13e

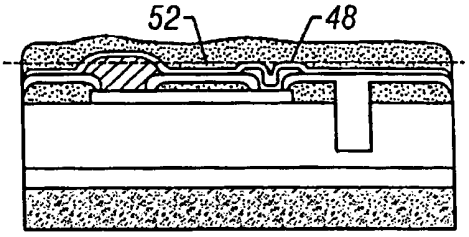

FIG. 13f

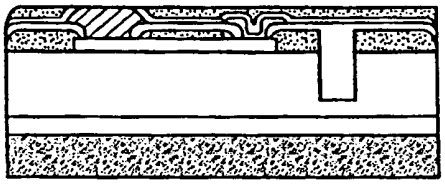

FIG. 13g

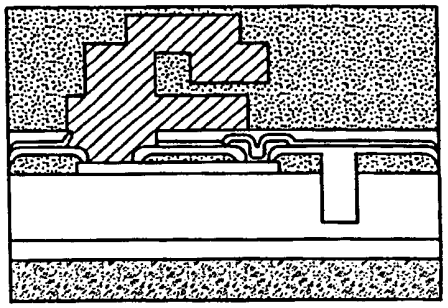

FIG. 13h

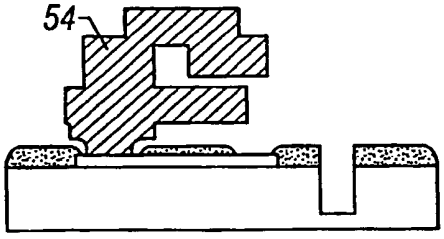

FIG. 13i

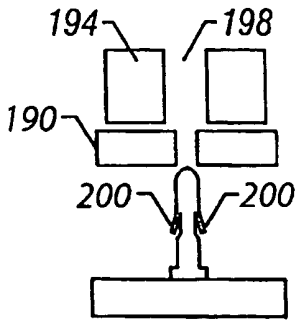

FIG. 14a

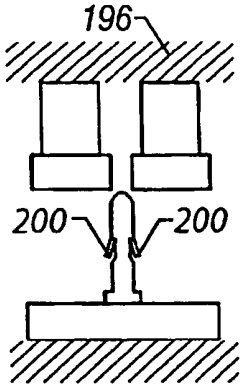

FIG. 14b

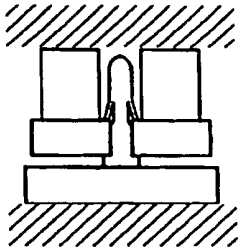

FIG. 14c

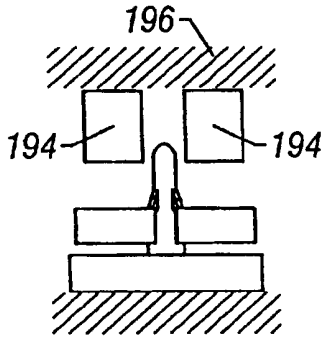

FIG. 14d

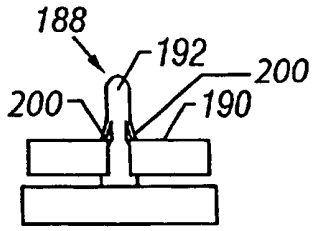

FIG. 14e

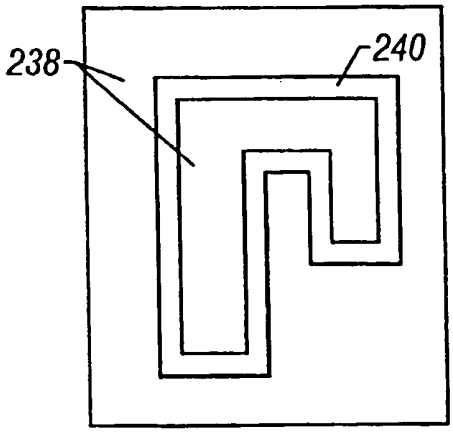

FIG. 15a

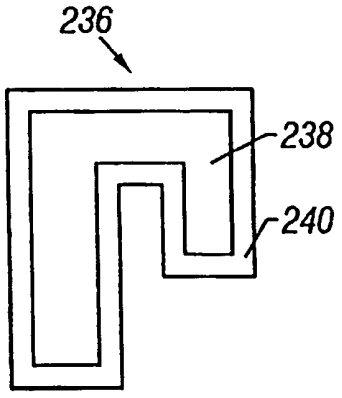

FIG. 15b

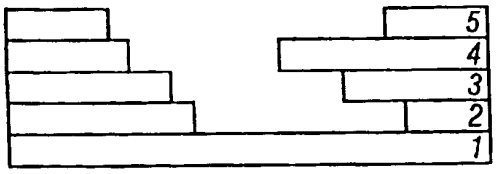

FIG. 16a

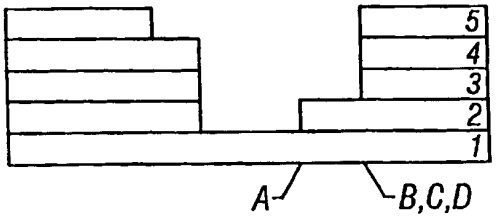

FIG. 16b

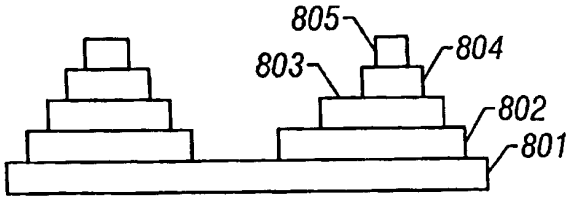

FIG. 16c

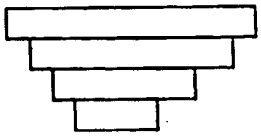

FIG. 16d

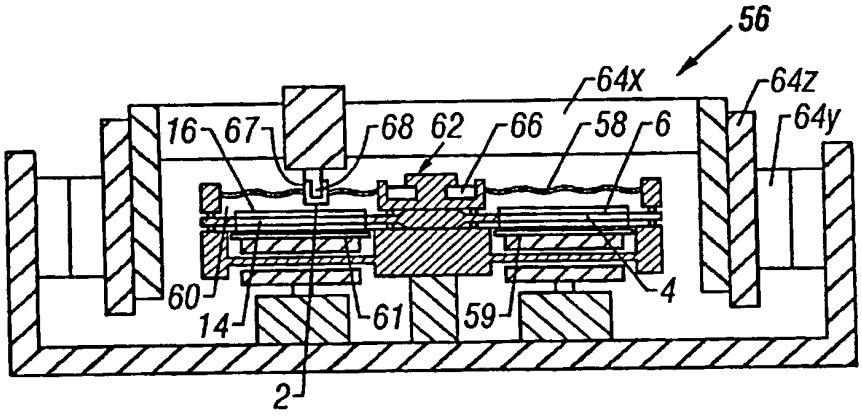

FIG. 17

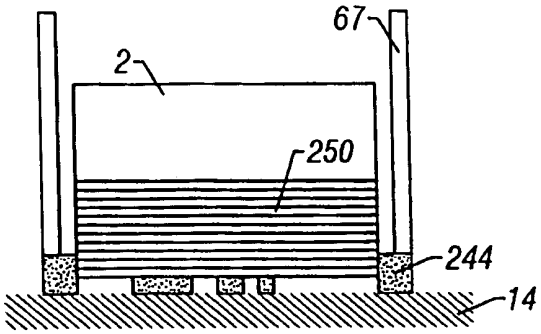

FIG. 18

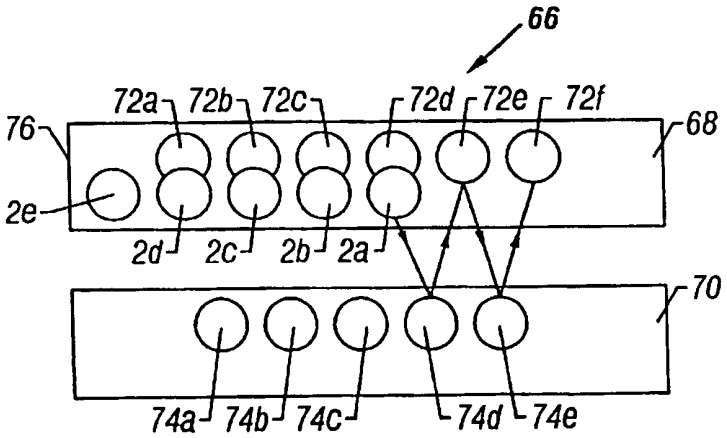

FIG. 19

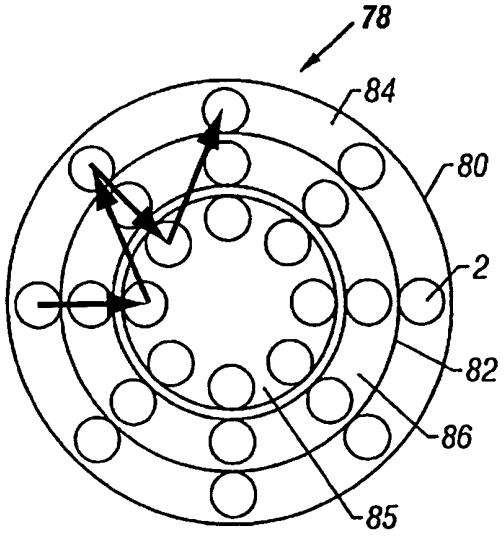

FIG. 20

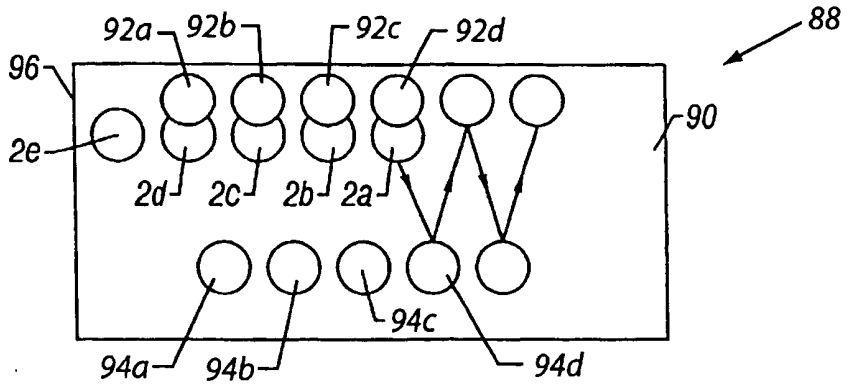

FIG. 21

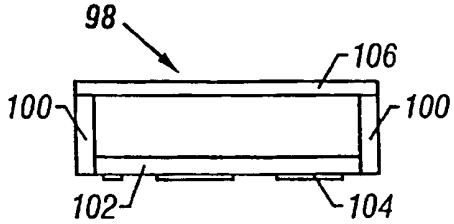

FIG. 22

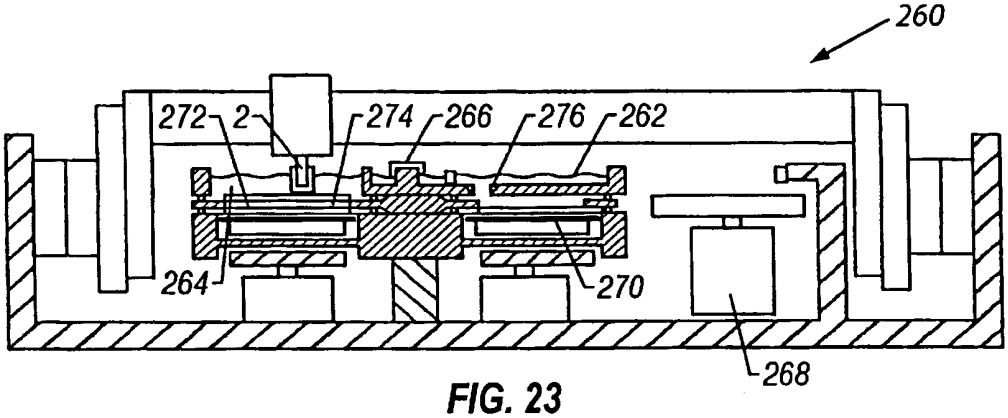

FIG. 23

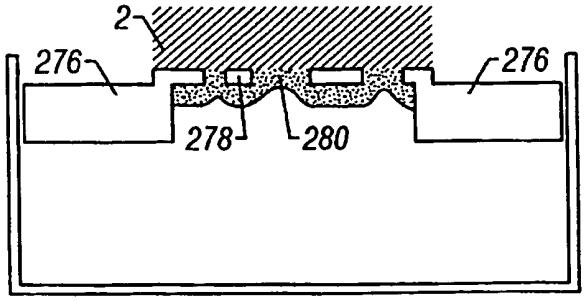

FIG. 24

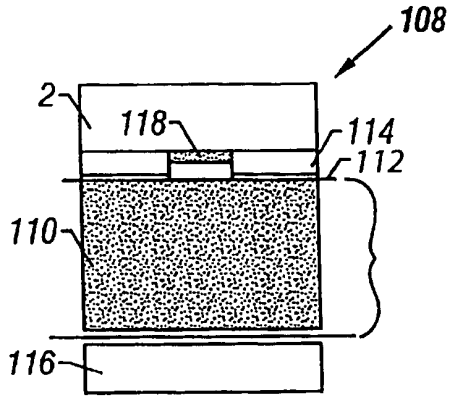

FIG. 25

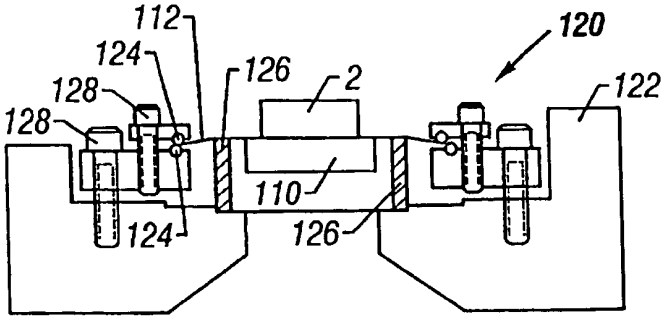

FIG. 26

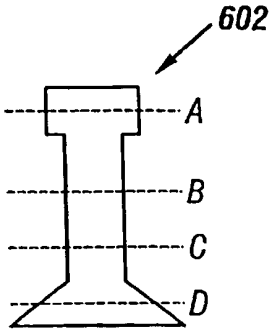

FIG. 27

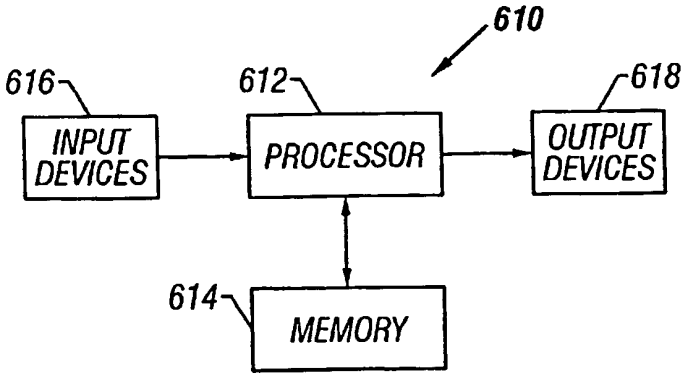

FIG. 28

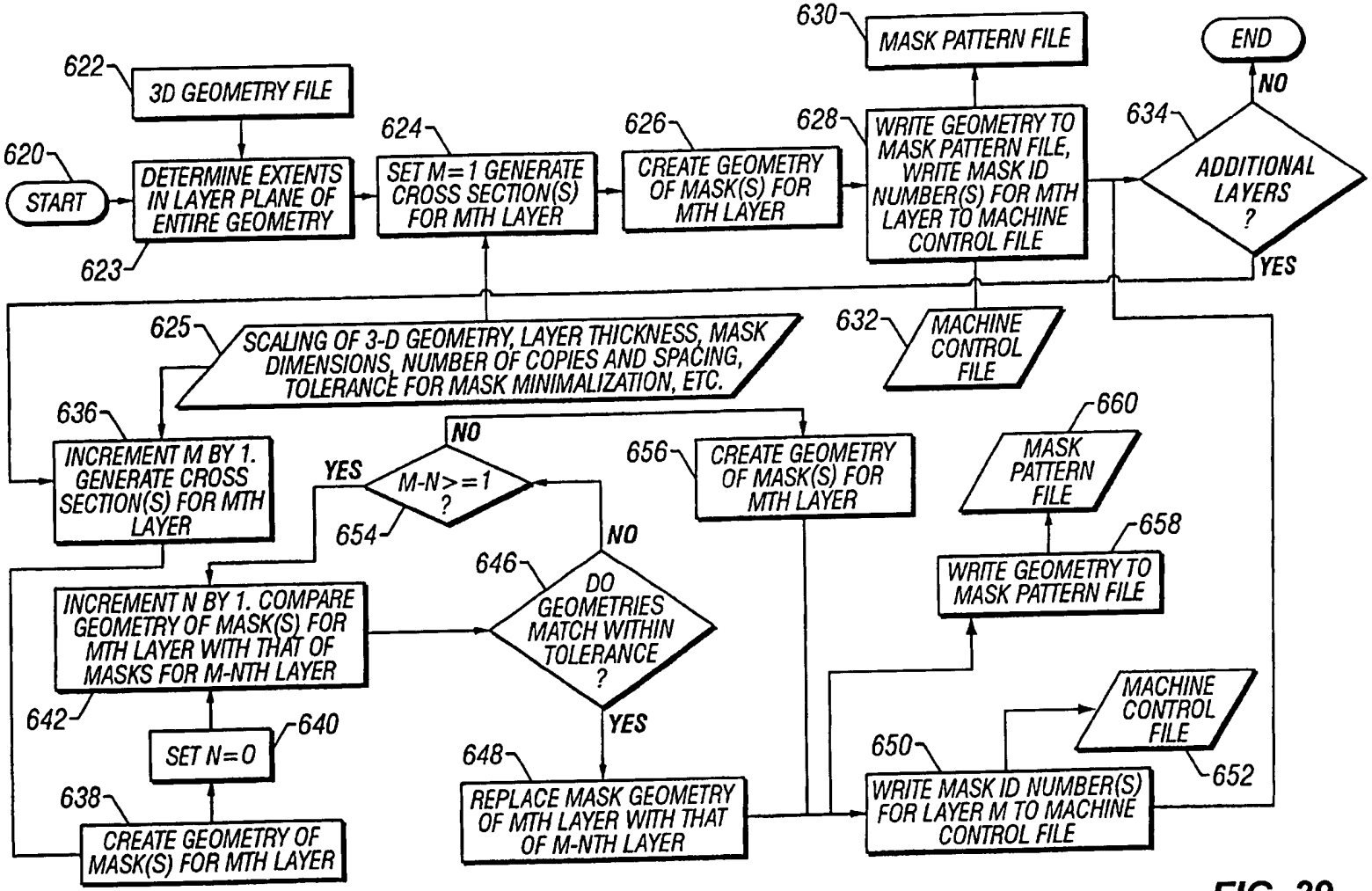
START
620
DETERMINE EXTENTS IN LAYER PLANE OF ENTIRE GEOMETRY
623
3D GEOMETRY FILE
622
SET M=1 GENERATE CROSS SECTION(S) FOR MTH LAYER
624
CREATE GEOMETRY OF MASK(S) FOR MTH LAYER
626
WRITE GEOMETRY TO MASK PATTERN FILE, WRITE MASK ID NUMBER(S) FOR MTH LAYER TO MACHINE CONTROL FILE
628
MASK PATTERN FILE
630
ADDITIONAL LAYERS ?
634
NO
YES
END
SCALING OF 3-D GEOMETRY, LAYER THICKNESS, MASK DIMENSIONS, NUMBER OF COPIES AND SPACING, TOLERANCE FOR MASK MINIMALIZATION, ETC.
625
MACHINE CONTROL FILE
632
INCREMENT M BY 1. GENERATE CROSS SECTION(S) FOR MTH LAYER
636
M-N>=1 ?
654
NO
YES
CREATE GEOMETRY OF MASK(S) FOR MTH LAYER
656
MASK PATTERN FILE
660
INCREMENT N BY 1. COMPARE GEOMETRY OF MASK(S) FOR MTH LAYER WITH THAT OF MASKS FOR M-NTH LAYER
642
DO GEOMETRIES MATCH WITHIN TOLERANCE ?
646
NO
YES
WRITE GEOMETRY TO MASK PATTERN FILE
658
SET N=0
640
CREATE GEOMETRY OF MASK(S) FOR MTH LAYER
638
REPLACE MASK GEOMETRY OF MTH LAYER WITH THAT OF M-NTH LAYER
648
WRITE MASK ID NUMBER(S) FOR LAYER M TO MACHINE CONTROL FILE
650
MACHINE CONTROL FILE
652

FIG. 29

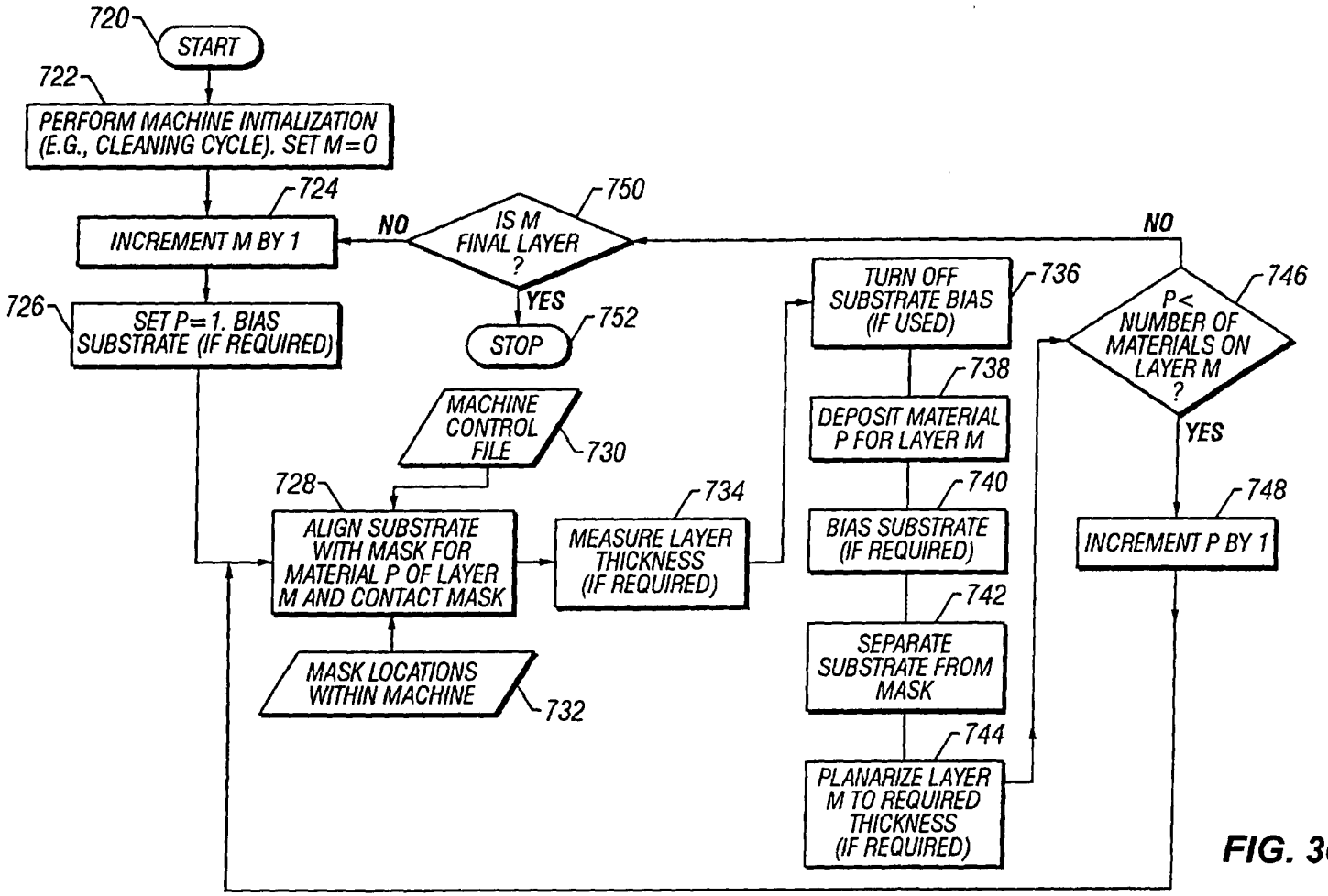
720
START
722
PERFORM MACHINE INITIALIZATION (E.G., CLEANING CYCLE). SET M=0
724
INCREMENT M BY 1
726
SET P=1. BIAS SUBSTRATE (IF REQUIRED)
728
ALIGN SUBSTRATE WITH MASK FOR MATERIAL P OF LAYER M AND CONTACT MASK
MACHINE CONTROL FILE
730
MASK LOCATIONS WITHIN MACHINE
732
734
MEASURE LAYER THICKNESS (IF REQUIRED)
736
TURN OFF SUBSTRATE BIAS (IF USED)
738
DEPOSIT MATERIAL P FOR LAYER M
740
BIAS SUBSTRATE (IF REQUIRED)
742
SEPARATE SUBSTRATE FROM MASK
744
PLANARIZE LAYER M TO REQUIRED THICKNESS (IF REQUIRED)
746
P< NUMBER OF MATERIALS ON LAYER M ?
NO
YES
748
INCREMENT P BY 1
750
IS M FINAL LAYER ?
NO
YES
752
STOP

FIG. 30

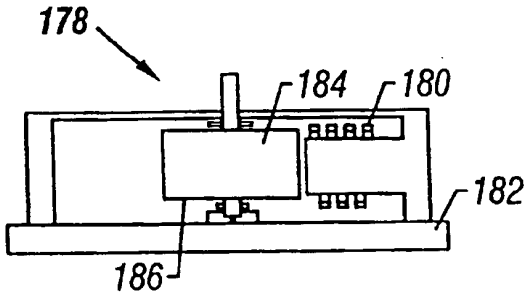

FIG. 31

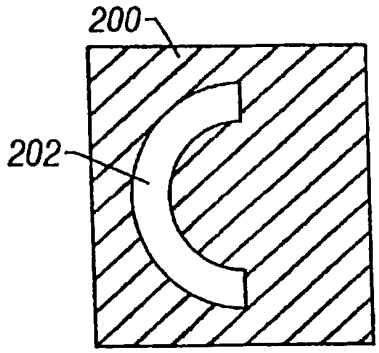

FIG. 32a

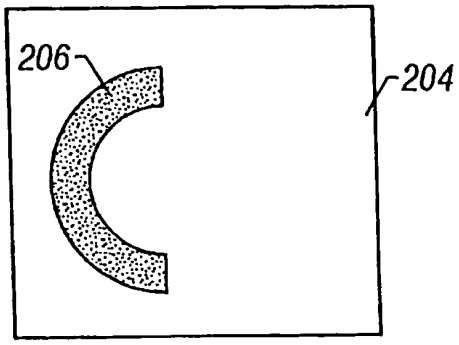

FIG. 32b

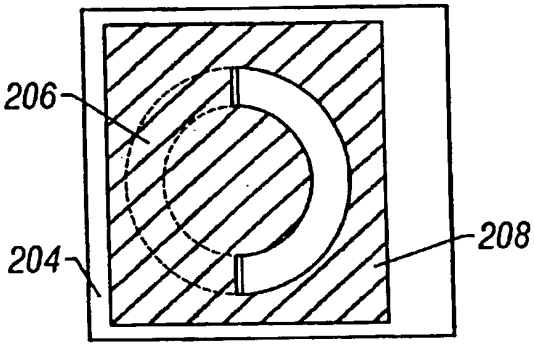

FIG. 32c

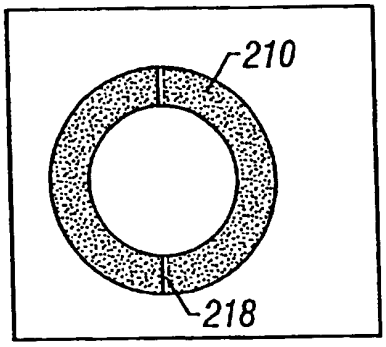

FIG. 32d